



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H02B 1/24, H02G 1/02, 3/02, 5/02, H01R 4/30, 13/62, 11/26		(11) International Publication Number: WO 99/22430
A1		(43) International Publication Date: 6 May 1999 (06.05.99)
(21) International Application Number: PCT/AU98/00899 (22) International Filing Date: 29 October 1998 (29.10.98) (30) Priority Data: PP 0084 29 October 1997 (29.10.97) AU (71) Applicant (for all designated States except US): TAPPAT ENGINEERING PTY. LIMITED [AU/AU]; 16 Powells Road, Brookvale, NSW 2100 (AU). (72) Inventor; and (75) Inventor/Applicant (for US only): DANNENBERG, Patrick [AU/AU]; 6 Powells Road, Brookvale, NSW 2100 (AU). (74) Agent: GRIFFITH HACK; G.P.O. Box 4164, Sydney, NSW 2001 (AU).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published With international search report.
(54) Title: ELECTRICITY DISTRIBUTION SYSTEM		
(57) Abstract		
<p>An apparatus for providing for distribution of an electricity supply from a plurality of supply cables (2-5), to a plurality of output cables (8-11) is disclosed, the apparatus comprising an insertion plate (12) through which the supply cables are inserted; a series of row distribution units (18-21), one for each of the plurality of supply cables (2-5) the row distribution units (18-21) having a series of output distribution connection points arranged along at least one surface thereof and at least one connector for interconnecting with a corresponding supply cable, and a number of the row distribution units (18-21) further including a series of apertures (22) for the passing through of non-connected supply cables through the row distribution units (18-21).</p>		

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Electricity Distribution SystemField of the Invention

The present invention relates to the field of electricity distribution at the level of distribution from street lighting or the like.

Background of the Invention

Previous methods for distribution of electricity are well known. The requirement of such techniques are the distribution of a high current carrying source input cable to a number of smaller current carrying output cables. Further, multiphase power distribution systems are normally employed wherein multiphase cables are utilised to replicate the form of distribution.

Unfortunately, the standard techniques utilised for interconnecting high current carrying cables are excessively cumbersome and require specialised equipment and crimping tools for manipulating cable connections. Further, heat shrinking of thermoplastics is often utilised as a final insulation.

It should be further noted that high current carrying cables are often extremely thick and therefore difficult to be handled by mere manual mechanisms such as bending the cable by hand etc. It is therefore often difficult to allow for fine adjustment of cable positions when interconnecting them to other cables. Further, it is desirable to have a simplified connect/disconnect mechanism which allows for the rapid connection and disconnection of one cable from another.

Further, prior art methods do not deal suitably with the situation where a temporary, for example, seasonal electricity supply is required. For example, where the electricity is to be supplied to an event such as a "show" the distribution system need only be in place while the "show" is being held. Further, due to the high flexibility requirements and fluctuating loads, it is desirable to provide for open point connections so as to enable a group

of transformers to be operated together. The use of open point links allows the transfer of load in accordance with requirements and is also particularly useful when servicing is required.

5 Where a fluctuating seasonal demand is required, a high degree of versatility is an extremely desirable factor. Unfortunately, the prior art system of utilising crimping tools and heat shrinking processes does not provide for a high degree of flexibility when changes must
10 be made. Further, the use of lug and crimping tools is often in an extremely dangerous environment in that live wires must be dealt with and the crimping is often carried out in an electrically active environment.

15 It would therefore be desirable to provide for a more flexible environment in which to provide for electrical interconnection of high current carrying cables.

Summary of the Invention

20 It is an object of the present invention to provide for an alternative form of cable interconnection system which eliminates or ameliorates a number of disadvantages of prior art systems.

25 In accordance with a first aspect of the present invention, there is provided an apparatus for providing for distribution of an electricity supply from a plurality of supply cables, to a plurality of output cables, the apparatus comprising an insertion plate through which the supply cables are inserted; a series of row distribution units, one for each of the plurality of supply cables, the row distribution units having a series of output
30 distribution connection points arranged along at least one surface thereof and at least one connector for interconnecting with a corresponding supply cable, and a number of the row distribution units further including a series of apertures for the passing through of non-
35 connected supply cables through the row distribution units.

Preferably, the row distribution units are arranged parallel to one another in a tiered structure and affixed to a backing plate and the output distribution connection points are staggered from one row distribution unit to the next. The output distribution connection points can include a series of bifurcated tongues for insertion of a connector blocks. The connector blocks can include two spaced apart bars for insertion of the bifurcated tongue between, the bars having a clamping means for clamping the bars firmly against the bifurcated tongue. The connector blocks can further include a resilient means for resiliently holding the bars together.

The connector blocks can further include a slot for the insertion of an output cable, the slot including a series of clamps so as to hold the output cable in the slot, the position in the slot of an end of the output cable being adjustable by means of release of the clamps.

Preferably, the connector block is further covered with insulation material apart from the area forming electrical contact with the tongue and to any user adjustable portion of the connector block. The output distribution points can protrude from a covering, the covering insulating the row distribution units from other forms of electrical contact with an external manipulator.

Further preferably the insertion plate includes a lip around an external border thereof and the apparatus further comprises a covering portion having an end inserted under the lip. The apparatus can also include a backing plate having a slot into which is slotted the covering portion.

In accordance with a further aspect of the present invention, there is provided a connector unit for interconnecting a conductive cable with a conductive distribution plate having at least one protruding strut the connector unit including two spaced apart bars for insertion of the strut between, the bars having a clamping means for clamping the bars firmly against the protruding

strut.

The connector blocks further can include a spacing mechanism including a resilient means for resiliently spacing the bars a predetermined distance from one another.

5 The protruding strut can comprise a bifurcated tongue such that a central slot of the bifurcated tongue mates with portions of the spacing mechanism.

Brief Description of the Drawings

10 Notwithstanding any other forms which may fall within the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

15 Fig. 1 is a perspective view of a junction box constructed in accordance with the principles of the present invention;

 Fig. 2 illustrates a portion of the junction box of Fig. 1;

 Fig. 3 illustrates a connector device utilised in the preferred embodiment;

20 Fig. 4 is an exploded perspective view of a portion of the connector of Fig. 3;

 Fig. 5 is an exploded perspective of the connector device and associated covering;

25 Fig. 6 is a perspective view of a simple connector tool; and

 Fig. 7 illustrates an exploded perspective of an alternative form of the portion of the junction box previously illustrated in Fig. 2; and

 Fig. 8 is a perspective illustrating a capping unit.

30 Description of Preferred and Other Embodiments

 Turning initially to Fig. 1, there is illustrated a junction box 1 constructed in accordance with the principles of the present invention. The junction box 1 includes as its input a series of high current carrying
35 cables 2-5. The output of the junction box includes a large number of output cables 8-11. The input cables 2-5

are passed through a lid portion 12 and corresponding clamp arrangements eg. 13 which provide for an almost weather-proof seal from water running down from above the junction box 1 by means of a gland sealing arrangement. The
5 weather-proof seal is enhanced by a cover portion 14 which mates with a backing portion 15 the mating being via a slot eg. 16 in the backing portion 15.

Each of the cables 2-5 is connected to a corresponding row connection unit 18-21. One of the cables eg. 3 is
10 connected to a corresponding row connection unit eg. 18 with the other cables eg. 2 passing through a suitable aperture eg. 22 so as to progress on to a corresponding board. Each row unit eg. 18 provides for an interconnection between the high current carrying cable eg.
15 3 and a corresponding series of output cables eg. 8-11. The interconnection is via a series of connectors eg. 25-28. The connectors interconnect the output line with a corresponding portion on the board 18.

Turning now to Fig. 2, there is illustrated, by way of
20 example, a single board 30 which includes an insulated portion 31 upon which a conductive portion 32 is mounted. The conduction portion 32 includes a series of prongs eg. 33 upon which connectors are mounted. Additionally, a clamping unit comprising portions 35, 36 is provided for
25 clamping a high current carrying cable eg. 37 to the row unit 30. The conductive portion 32 includes a series of prongs eg. 33 upon which connectors are mounted. The conductive portions of the row unit can be preferably also encased in a poly-carbonate plastic mounting (not shown)
30 with the prongs 33 protruding from the poly-carbonate casing.

Turning now to Fig. 3, there is illustrated the interaction between a protruding prong eg. 40 and its corresponding interconnecting connector 41. The connector
35 41 comprises two parts 42, 43 which engage the prong 40. The connector 41 interconnects an output cable eg. 44 which

is affixed to the connector 41 by means of tightening screws 46, 47. The use of the tightening screws 46, 47 allows for an initial degree of play for the connector 44 in its interconnection to the connector 41. The plate 43 is spring-loaded such that upon insertion of the connector 41 on prong 40, the plate 43 resiliently yields. Subsequently, the connector 41 includes tightening means for tightening the pressing of the two plates 42, 43 around the prong 40.

Turning now to Fig. 4, there is illustrated an exploded perspective view of the connector 41. The spring-loading of the plate 43 against the plate 42 is provided by means of two identical spring-loading units which can comprise, for example, a first insert 50, spring 51 and screw 52. A tightening screw 56 is provided for tightening the plates 43, 42 together around the prong 40 (Fig. 3).

Further, the connector 41 can be encased in polycarbonate or the like with suitable apertures for accessing the relevant screws through the use of a screw driver or Allen key arrangement in addition to a slot aperture for the insertion of the prong between the plates 42, 43. One arrangement is illustrated in Fig. 5 where a connector 41 is surrounded by two insulating polycarbonate units 60, 61. The polycarbonate units 60, 61 are designed to mate around the surfaces of the connector 41 and be attached together by means of screw holes eg. 63, 64. Access to the screws 46, 47 is provided via access holes 66, 67. Further, portions 68, 69, when joined together, allow for an access hole to access tightening screw 56 utilizing an allen key tool such as that illustrated in Fig. 6.

It will be evident that other possible compact design arrangements are possible. For example, in Fig. 7, there is illustrated an alternative form of arrangement of the connector block of Fig. 2. In the arrangement 70 of Fig. 7 a covering unit 71 is provided which mates with a conductive unit 72 which contains a series of prongs eg. 73

which mate with corresponding apertures eg. 74 in the unit 71. The unit 72 can include a series of screw holes eg. 75 for attachment of conductive taping off units 77 to which can be attached a conductive distribution cable. The

5 conductive unit 77 is designed to be firmly attached by means of screws eg. 78, 79 and a conductive lead is inserted in aperture 80 and firmly fixed in place by means of bolt 81. The conductive unit 72 can comprise two

10 suitable formed metal bars joined together by means of screws 84, 85. The unit 72 can be slotted partly within the unit 71 so that the prongs eg. 73 protrude from corresponding apertures eg. 74. A back cover unit 87 is further provided to mate with the front cover unit 71 by means of a series of screw holes eg. 88 which mate with

15 screws inserted through corresponding screw holes eg. 89. The combined unit can then be mounted a predetermined distance from the back planar surface by means of spacer units eg. 90 which again include mating portions eg. 91, 92 which mate with corresponding portions 88, 87 so as to be

20 firmly attached thereto and further attached to a backing surface in a similar manner to that discussed with reference to the arrangement of Fig. 2 so as to allow supply cables to pass therethrough.

Further, the connector 41 can be provided with a fully

25 insulating cover portions and can be simply aligned with a corresponding fork prong eg. 73 of Fig. 7, and subsequently a tightening unit such as that illustrated in Fig. 6 can be utilized to lock the connection unit in place. This results in a highly compact arrangement able to fit a large

30 number of connectors in a small area. The ability to initially provide for a loose flexible fit and to subsequently lock connectors into place allows for flexibility of movement of wires and also flexibility of access when alterations are required and lower levels of

35 the tiered structure must be accessed. These can be accessed by simply loosening off a number of the other

connectors and temporarily detaching them before accessing lower levels.

It can therefore be seen that the embodiments provide for effective distribution of high current carrying loads in a highly flexible manner. Further, the disclosed arrangements allows for ready alteration of interconnects by means of snap-fitting plugs. The junction box of the preferred embodiment allows for rapid assemblage of an interconnect and the utilisation of the tiered structure allows for the simple insertion of difficult to manoeuvre high current cables into the junction box. The junction box is further provided in a substantially weather proof container so as to reduce the effects of any water flow around the junction box. The connectors provide for a simple connect/disconnect operation of the junction box.

The utilization of the snap fitting plugs allows for a simple degree of "play" in that the length of wires interconnected can be suitably adjusted.

It would be appreciated by a person skilled in the art that numerous variations and/or modifications any be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

We Claim:

1. An apparatus for providing for distribution of an electricity supply from a plurality of supply cables, to a plurality of output cables, the apparatus comprising:
 - 5 an insertion plate through which said supply cables are inserted;
 - a series of row distribution units, one for each of said plurality of supply cables, said row distribution units having a series of output distribution connection
 - 10 points arranged along at least one surface thereof and at least one connector for interconnecting with a corresponding supply cable, and a number of said row distribution units further including a series of apertures for the passing through of non-connected supply cables
 - 15 through said row distribution units.
2. An apparatus as claimed in claim 1 wherein said row distribution units are arranged parallel to one another in a tiered structure and affixed to a backing plate and said output distribution connection points are staggered
- 20 from one row distribution unit to the next.
3. An apparatus as claimed in any previous claim wherein said output distribution connection points include a series of bifurcated tongues for insertion of a connector blocks.
- 25 4. An apparatus as claimed in claim 3 wherein said connector blocks include two spaced apart bars for insertion of said bifurcated tongue between, said bars having a clamping means for clamping said bars firmly against said bifurcated tongue.
- 30 5. An apparatus as claimed in claim 4 wherein said connector blocks further include a resilient means for resiliently holding said bars together.
6. An apparatus as claimed in any of claims 3 to 5 wherein said connector blocks further include a slot for
- 35 the insertion of an output cable, said slot including a series of clamps so as to hold said output cable in said

slot, the position in said slot of an end of said output cable being adjustable by means of release of said clamps.

7. An apparatus as claimed of claims 4, 5 or 6 wherein said connector block is further covered with insulation material apart from the area forming electrical contact with said tongue and to any user adjustable portion of said connector block.

8. An apparatus as claimed in any previous claim wherein said output distribution points protrude from a covering, said covering insulating the row distribution units from other forms of electrical contact with an external manipulator.

9. An apparatus as claimed in claim 1 wherein said insertion plate includes a lip around an external border thereof and said apparatus further comprises a covering portion having an end inserted under said lip.

10. An apparatus as claimed in claim 9 wherein said apparatus is mounted on a backing plate having a slot into which is slotted said covering portion.

11. An apparatus as claimed in any previous claim wherein said row distribution units further includes a conductive bar for distribution of an electrical supply to said output connection points and said conductive bar further comprises means for attaching a conductive distribution block to said conductive bar.

12. An apparatus as claimed in any previous claim further comprising a series of insulating caps for covering output distribution connection points when not in use.

13. A connector unit for interconnecting a conductive cable with a conductive distribution plate having at least one protruding strut said connector unit including two spaced apart bars for insertion of said strut between, said bars having a clamping means for clamping said bars firmly against said protruding strut.

14. An apparatus as claimed in claim 13 wherein said connector blocks further include a spacing mechanism

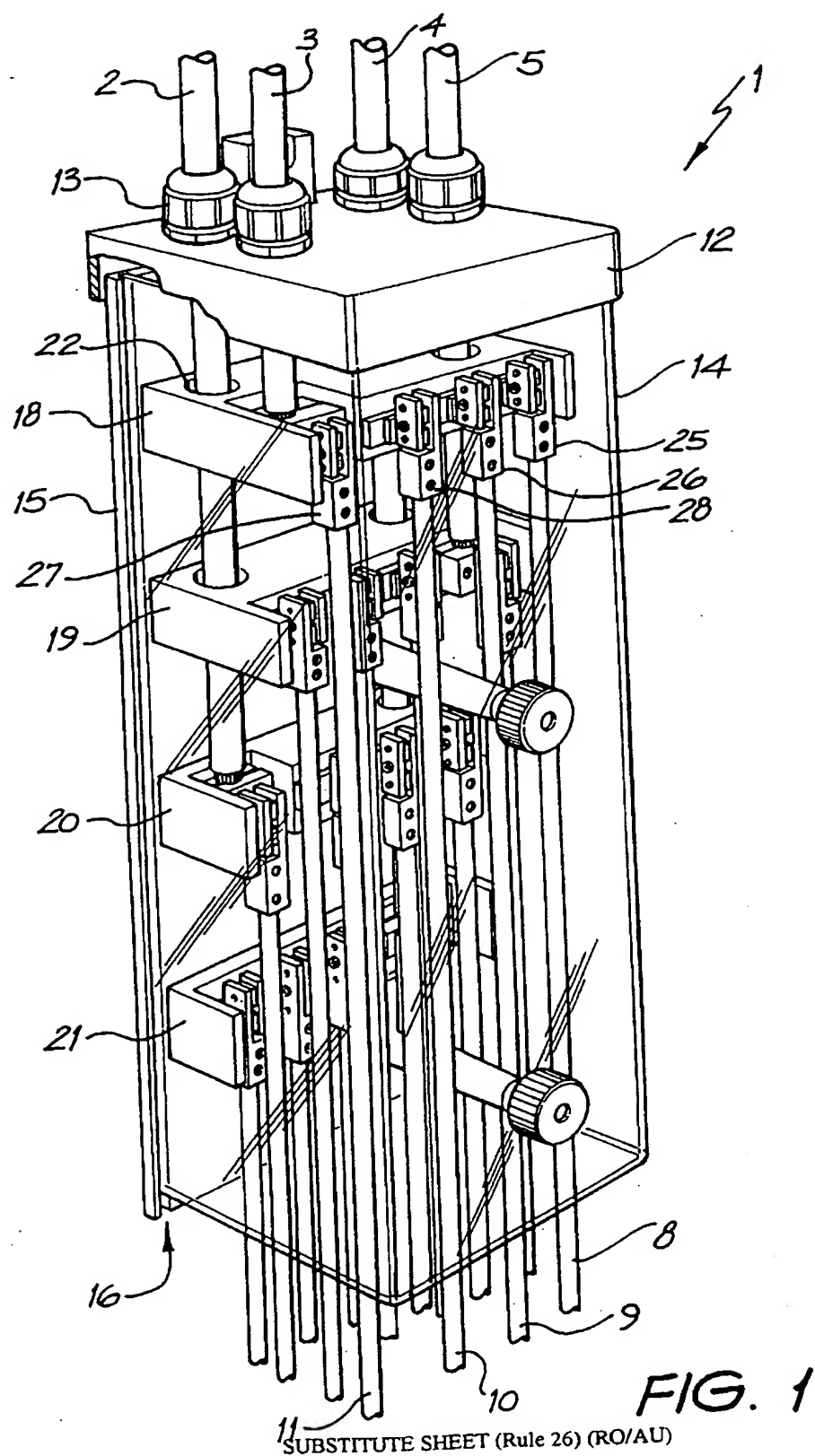
including a resilient means for resiliently spacing said bars a predetermined distance from one another.

15. An apparatus as claimed in claim 14 wherein said protuding struct comprises a bifurcated tongue.

5 16. An apparatus as claimed in claim 15 wherein a central slot of said bifurcated tongue mates with portions of said spacing mechanism.

 17. An apparatus for providing for distribution of an electricity supply from a plurality of supply cables, to a
10 plurality of output cables, substantially as hereinbefore described with reference to the accompanying drawings.

 18. A method for providing for distribution of an electricity supply from a plurality of supply cables, to a plurality of output cables, substantially as hereinbefore
15 described with reference to the accompanying drawings.



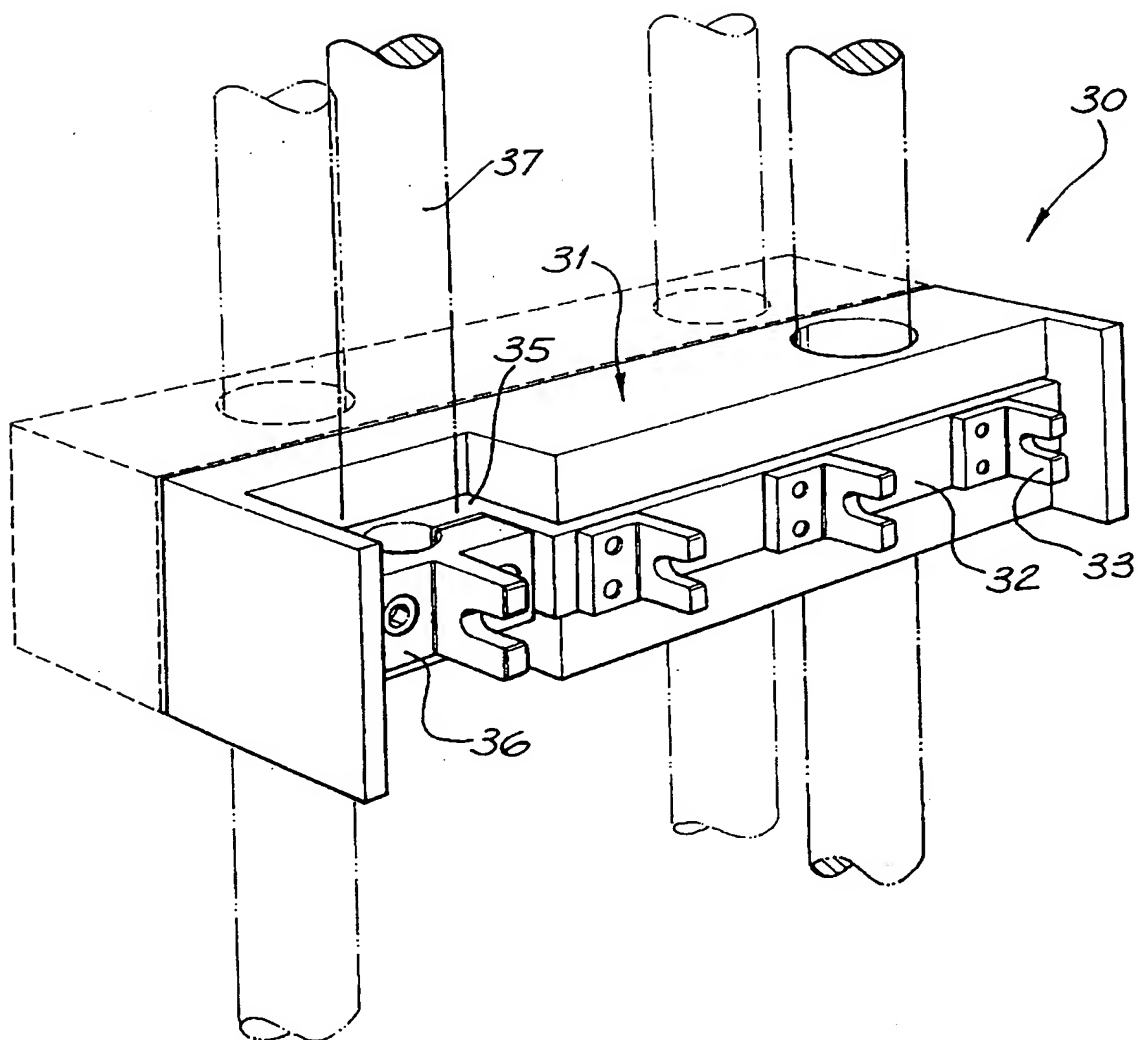


FIG. 2

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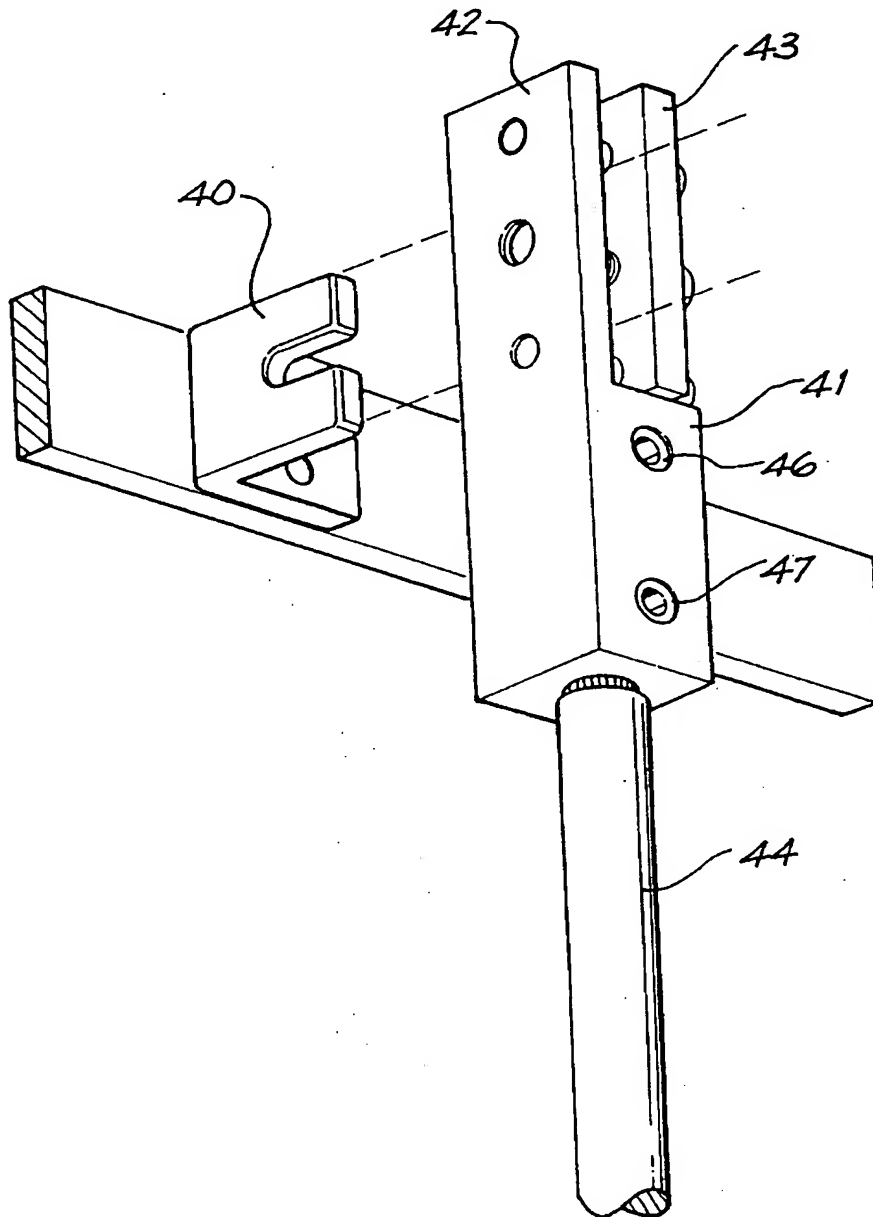


FIG. 3

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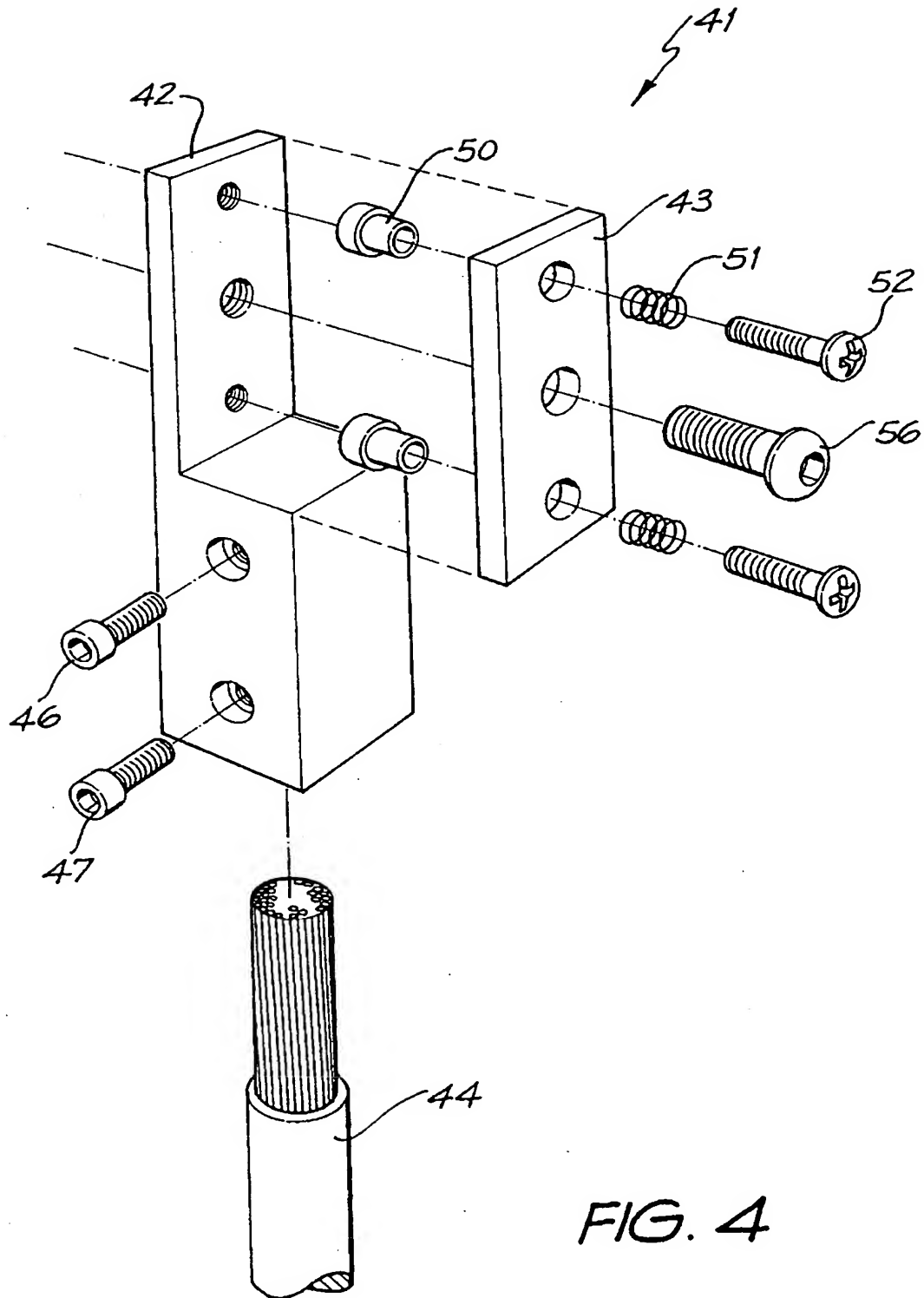


FIG. 4

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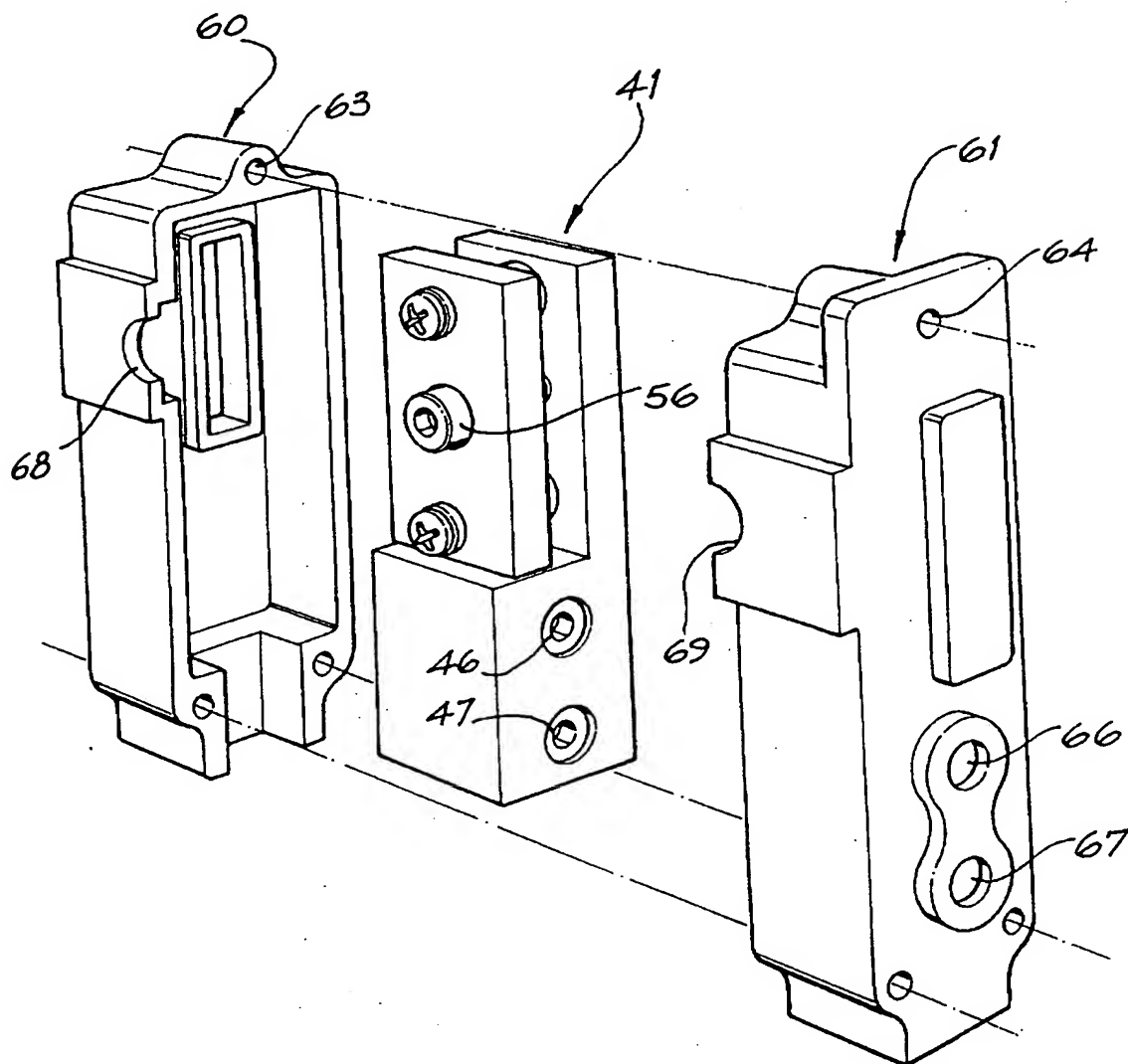


FIG. 5

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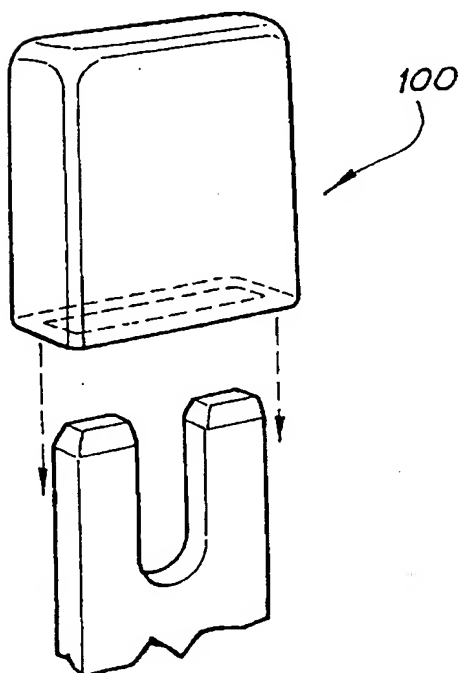
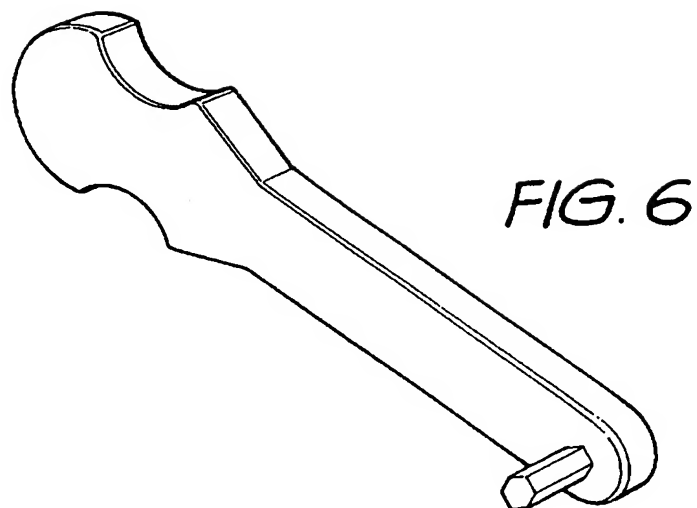


FIG. 8

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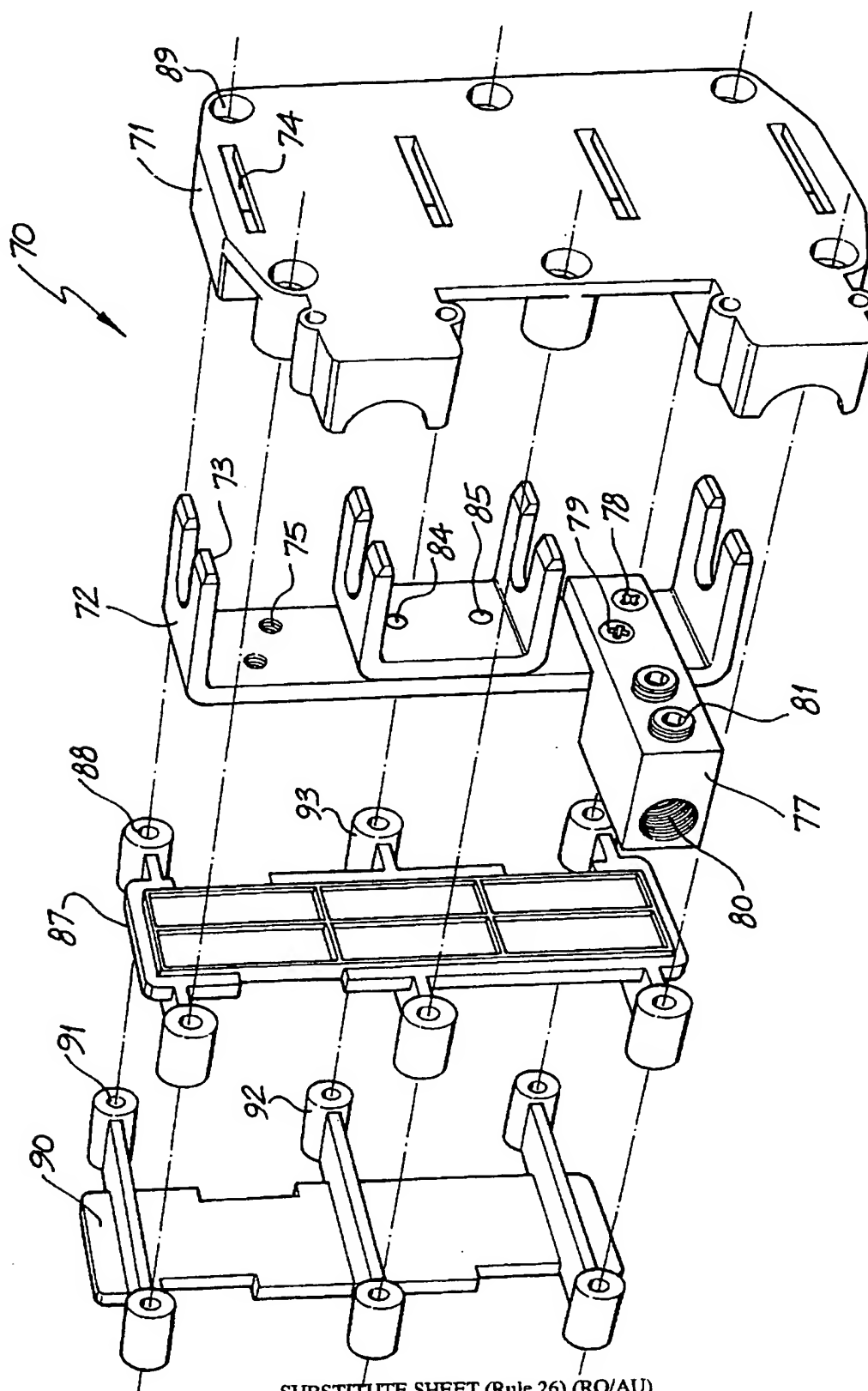


FIG. 7

SUBSTITUTE SHEET (Rule 26) (RO/AU)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 98/00899

A. CLASSIFICATION OF SUBJECT MATTER												
Int Cl ⁶ : H02B 1/24, H02G 1/02, 3/02, 5/02, H01R 4/30, 13/62, 11/26												
According to International Patent Classification (IPC) or to both national classification and IPC												
B. FIELDS SEARCHED												
Minimum documentation searched (classification system followed by classification symbols) IPC: H02B 1/IC, H02G 3/IC, 5/IC, H01R 4/38/IC, 11/26/IC, 13/621/IC, 25/IC, 31/IC												
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU: IPC as above												
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT: IPC & Keywords												
C. DOCUMENTS CONSIDERED TO BE RELEVANT												
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.										
X	US 5747737 A (WAEHNER) 5 May 1998 Whole document	1-12, 17-18										
Y	EP 0342079 A (SAREL APPAREILLAGE ELECTRIQUE) 15 November 1989 Fig 1, abstract	1										
Y	DE 4437220 A (POLLET. W) 25 April 1996 Fig 1, abstract	1										
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex												
<p>* Special categories of cited documents:</p> <table border="0"> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"E" earlier application or patent but published on or after the international filing date</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	"P" document published prior to the international filing date but later than the priority date claimed	
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Date of the actual completion of the international search 23 December 1998		Date of mailing of the international search report 15 JANUARY 1999										
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929		Authorized officer SOOSA GNANASINGHAM Telephone No.: (02) 6283 2172										

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 98/00899

C (Continuation).

DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 3942953 A (RITTAL-WERK RUDOLF LOH GMBH & CO KG) 27 June 1991 Whole document	13-16
X	GB 1423391 A (WARD & GOLDSTONE LTD) 4 February 1976 Fig 2, 4	13-16
X	US 5226841 A (THÖRNER) 13 July 1993 Whole document	13-16
P, X	DE 19736620 A1 (FUJI ELECTRIC CO LTD) 26 February 1998 Fig 1-8	13-16
X	US 3893744 A (PORAZINSKI) 8 July 1975 Fig 1-5	13-16

Form PCT/ISA/210 (continuation of second sheet) (July 1998) copdeg

INTERNATIONAL SEARCH REPORT

international application No.

PCT/AU 98/00899

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-12, 17-18
Apparatus providing distribution of electricity supply to cables.
 2. Claims 13-16
A connector unit, as reasoned on extra sheet
-
1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
 2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
 3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
 4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 98/00899

Box II Continued

1. Claims 1-12 and 17-18 are directed to an apparatus providing distribution of electricity supply to output cables from a plurality of supply cables, the apparatus comprising a series of row distribution units for each of said supply cables, the row distribution units having distribution connection points and apertures.
2. Claims 13-16 are directed to a connector unit with two spaced apart bars and a clamping means.

level patent family

International application No.
PCT/AU 98/00899

Patent Document Cited in Search Report				Patent Family Member			
EP	342079	FR	2631495				
DE	4437220	DE	19614751				
DE	3942953	EP	435026				
US	5226841	EP	460145	HK	103/94	WO	9110270
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